UCRL-JC-120368 ABS

ANOMALOUS TEMPERATURE DEPENDENCE OF INTERLAYER COUPLING IN Fe/Si MULTILAYERS

R.P. Michel, A. Chaiken, M.A. Wall, Lawrence Livermore National Lab, Livermore CA 94550, J.W. Dykes, National Institute of Standards and Technology, Boulder CO 80303, J.F. Ankner and H. Kaiser, Univ. of Missouri-Columbia, Columbia MO 65211

The magnetic coupling of the Fe layers in Fe/Si multilayers strongly depends on the morphology of the iron-silicide interlayer that forms during deposition. Antiferromagnetic interlayer coupling is only observed in Fe/Si multilayers with crystalline interlayers in the CsCl structure.[1] Recently, it has been shown that single layers of Fe-Si in the CsCl structure can be grown epitaxially on Si over a range of stoichiometries.[2] FeSi films are reported to be Kondo insulators below 50 K. We find evidence of a magnetic phase transition in antiferromagnetically coupled Fe/Si multilayers. M_S measured in a constant applied field of 50 kOe shows $T^{3/2}$ behavior down to 10 K. However M(T) at a lower constant field peaks around 50 K and decreases at lower temperature, indicating enhanced antiferromagnetic coupling or a phase transition. The remanent magnetization increases monotonically with decreasing temperature and has been explained by invoking thermally activated coupling. However, the saturation field also increases with decreasing temperature, indicating a stronger antiferromagnetic interaction. We explore the suggestion[3] that the interlayer coupling is biquadratic in nature. Polarized neutron reflectometry has also been used to get a clearer picture of the complicated magnetic behavior of this multilayer system.

† Part of this work was performed under the auspices of the U. S. Department of Energy by LLNL under contract No. W-7405-ENG-48.

1. R. P. Michel, A. Chaiken, and M. A. Wall, 1995 Spring MRS Symp. L proceedings, to be published.
2. N. Onda, H. Sirringhaus, P. Steiner and H. von Kanel, Mat. Res. Soc. Symp. Proc. **280** 497 (1993).
3. E. E. Fullerton and S. D. Bader, private communication.